

## **REMARKS**

### **Claims Status**

Claims 1, 2, 6-11 and 13-23 are pending, with claim 1 being the sole independent claim. Claims 1 and 21 have been amended. No new matter has been added by way of this amendment. Reconsideration of the application is respectfully requested.

### **Overview of the Office Action**

Claims 1, 2, 6-11 and 19-23 stand rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 6,531,719 (“*Shibata I*”). Claims 13-18 stand rejected under 35 U.S.C. §103(a) as unpatentable over *Shibata I* in view of U.S. Patent No. 6,342,404 (“*Shibata II*”). Applicants have carefully considered the Examiner’s rejections, and the comments provided in support thereof, and respectfully disagree with the Examiner’s analysis. For the reasons which follow, it is respectfully submitted that all claims of the present application are patentable over the cited references.

### **Descriptive Summary of the Prior Art**

*Shibata I* relates to a “group III nitride compound semiconductor device comprising an undercoat layer having a surface on which a group III nitride compound semiconductor layer having a device function can be formed, [wherein] the surface of the undercoat layer contains inclined faces, [and] wherein the projected area ratio of the inclined faces to the whole surface of the undercoat layer on a plane of projection is in a range of from 5 to 100%” (see col. 1, line 65 thru col. 2, line 4 of *Shibata I*).

*Shibata II* relates to “a method for producing a group III nitride compound semiconductor device, [wherein the method] comprises the steps of: forming a first environment division and a second environment division on a surface of a substrate; and laminating a plurality of group III

nitride compound semiconductor layers for constituting a device on said first environment division” (see col. 1, lines 42-48 of *Shibata II*).

### **Patentability of the Claims Under 35 U.S.C. §103(a)**

Independent claim 1 includes the limitation “wherein the mirror layer has a plurality of planar reflection sub-surfaces, which are positioned obliquely with respect to a main plane of the electromagnetic radiation-generating region and each form an angle of between 10° and 50° with respect to the main plane”.

In rejecting claim 1 as unpatentable over *Shibata I* under 35 U.S. C. §103(a), the Examiner concedes that *Shibata I* fails to disclose this recited limitation - i.e. that the obliquely-positioned planar reflection sub-surfaces are each formed *at an angle of between 10 and 50 degrees with respect to the main plane*. The Examiner nevertheless states that:

[I]t would have been obvious to one of ordinary skill in the art to recognize that each planar reflection sub-surface of the mirror 25 of *Shibata et al.* forms an angle of between 10° and 50° with respect to the main plane of the radiation-generating region 17, because the mirror 25 [has] inclined faces that is formed as a texture structure that [are] shaped like teeth of a saw (note lines 5-13 in column 2 of *Shibata et al.*)

With all due respect, the only motivation for injecting this recited limitation of applicants' claim 1 into the disclosure of *Shibata I* can come from the teachings of applicants herein, using impermissible hindsight reconstruction.

The cited Figs. 11 and 12 of *Shibata I* each depict a reflection layer (15, 35, respectively) having a "texture structure" surface. According to *Shibata*, the phrase "texture structure" is intended to mean "a structure in which the surface of the undercoat layer is shaped like teeth of a saw in any sectional view, that is, a combination of a peak and a trough is repeated through an inclined face." (Col. 2, ll. 7-10) In each of Figs. 11 and 12, the "texture surface" is drawn as a regular, two-dimensional sawtooth pattern of peaks and troughs. *Shibata I*, however, contains no

teaching or suggestion as to any preferred or required angle or orientation, or range of angles or orientations, at which the faces of the "texture structure" may or should or must be placed in the resulting structure. Neither is there any statement or suggestion in *Shibata I* that the exact depictions of Figs. 11 and 12 should be carefully measured or dissected or studied to derive, from the exact sawtooth patterns shown in those drawings, a specific angle or range of angles at which the inclined faces should be oriented with respect to the main plane or substrate 11. From where, then, is one to obtain the required motivation to not only identify a particular angle at which the inclined surfaces in *Shibata I* should be oriented but, moreover, to determine a desired or advantageous or required *range* of angles such as that expressly set forth in applicants' claims? *Shibata I* quite simply lacks *any* such teaching or suggestion or motivation.

It is of course well known that the "teeth of a saw" are commonly configured with a wide range of inclinations that extends far beyond applicants' claimed range of 10 to 50 degrees; a literal reading of *Shibata's* express definition thus merely instructs the person of skill that the inclinations of the "texture structure" faces can be anywhere in the range  $0^\circ < x < 90^\circ$ , so long as the "texture surface" forms "a combination of a peak and a trough ... repeated through an inclined face". *Shibata I* presents *no* teaching or suggestion that planar reflection surfaces be obliquely oriented at angles between 10 and 50 degrees, as is expressly recited in applicants' independent claim 1, or indeed at any particular angle or range of angles.

Closer study of the *Shibata I* reference reveals the patentee's true teaching and intention concerning the configuration of the "texture structure". The embodiment of Fig. 8 depicts the same "sawtooth" "texture structure" of the undercoat layer 35. Fig. 9 "is a surface SEM photograph of an undercoat layer according to the embodiment shown in FIG. 8." (Col. 4, ll. 8-9) Thus, Fig. 9 is a high power *photograph* showing the actual "texture structure" that is merely diagrammatically depicted in Fig. 8 by the simplified two-dimensional sawtooth. In this regard, Fig. 9 clearly shows that the "texture structure" which is diagrammatically represented by the

regular sawtooth pattern in Fig. 8 (and in Figs. 11 and 12) is not regular at all but is, rather, a highly irregular series of variously-shaped lands and valleys having irregularly-angled and oriented sides and portions of sides that are disposed at a wide range of angles most certainly not limited to applicants' recited 10 to 50 degree range. *At the very least*, a person of ordinary skill viewing this SEM photograph to understand the intended "texture structure" of the *Shibata I* semiconductors would find no motivation whatsoever for limiting the orientations of the planar reflection surfaces to the range of 10 to 50 degrees with respect to the main plane. Rather, the SEM photograph teaches the person of skill that the "texture surface" should be formed of irregularly-shaped and variably-angled inclinations in a range seemingly defined by the relationship  $0^\circ < x < 90^\circ$ . *Shibata I* thus not only fails to provide motivation for the person of ordinary skill to modify its disclosure to limit the "texture surface" inclinations to the range 10 to 50 degrees, it actually *teaches away* from such a limited range of inclinations by the Fig. 9 depiction of the "texture structure" that is contemplated and described.

Moreover, based on the Fig. 9 SEM photograph, it is apparent that the *Shibata I* reference additionally fails to teach the provision of *planar* reflection surfaces as recited in applicants' claim 1, since each and every one of the inclined surfaces shown in Fig. 9 appears to have varying inclinations and is therefore quite clearly not at all planar. Based therefore on the Fig. 9 SEM photograph which explains the "texture structure" diagrammatically depicted in a simplified form by the two-dimensional sawtooth in Figs. 8, 11 and 12, the person of ordinary skill would have no basis or motivation for modification of the *Shibata I* "texture structure" to render such surfaces planar, absent impermissible hindsight reconstruction based on applicants' own teachings in the instant application.

*Shibata I* accordingly fails to teach or suggest or render obvious applicants' invention as recited in independent claim 1, and in each of claims 2, 6 to 11 and 13 to 23 which variously

depend therefrom. Reconsideration and withdrawal of the Section 103(a) rejection of claims 1, 2, 6 to 11, and 19 to 23 based on the *Shibata I* reference is therefore respectfully requested.

*Shibata II* fails to teach or suggest that which *Shibata I* lacks, and therefore likewise cannot render obvious any of applicant's pending claims based on the combination of *Shibata I* and *Shibata II*. Thus, with respect to claims 13 to 18, reconsideration and withdrawal of the Section 103(a) rejection based on the combination of *Shibata I* and *Shibata II* is respectfully requested.

### **Dependent claims**

As noted above, based on the patentability of independent claim 1, each of dependent claims 2, 6-11 and 13-23 is deemed patentable over the prior art.

At least the following dependent claims rejected in the Office Action additionally include recitations that still further distinguish over the prior art.

Dependent claim 2 recites that the “mirror layer is comprised of a reflection surface of the p-conducting semiconductor layer, which includes the plurality of planar sub-surfaces which are positioned obliquely with respect to the main plane of the electromagnetic radiation-generating region and each form the angle of between 10° and 50° with respect to the main plane”.

In the Office Action, the Examiner states (pg. 4) that “it would have been obvious to one of ordinary skill in the art to replace the n-type layer 16 of *Shibata et al.* with the p-type layer 18” and vice versa. Applicants respectfully disagree.

*Shibata I* utilizes p-doped GaN as a p-type layer 18 (see Fig. 7 of *Shibata I*). It is well-known to persons of ordinary skill in the art that p-doped GaN exhibits very poor conductivity in the lateral direction (i. e., in the horizontal orientation in the sectional view of *Shibata I* Fig. 7). If the n-doped layer 16 were to be positionally exchanged with the p-doped layer 18 in *Shibata I*,

current that is injected through contact 21 would not, or would only poorly, spread in the lateral direction. Active region 17 would accordingly remain un-energized or only poorly energized.

Moreover, it is not possible to apply contact layer 21 to the surface of the device facing away from contact layers 19 and 20, because the sapphire substrate 11 of the *Shibata I* structure is electrically insulating.

These characteristics of the *Shibata I* semiconductors would discourage, rather than suggest or motivate, a person of ordinary skill in the art to interchange the p-doped and n-doped layers 16 and 18 shown in *Shibata I*. Claim 2 is accordingly not rendered obvious under 35 U.S.C. §103(a) by *Shibata I*. With respect to the Examiner's reference to "product by process" limitations in claim 2, applicants point out that this limitation in claim 2 was removed in applicants' prior amendment.

Dependent claims 7-11 recite a multilayer reflective structure. The Examiner concedes that *Shibata I* fails to teach this claimed feature, but fails to provide any reference or other evidentiary basis for his contention that:

...it would have been obvious to one of ordinary skill in the art to form the mirror layer of Shabata et al. having a plurality of different layers such as [a] highly reflective layer, a protective layer and a joining layer in order to obtain a maximum efficiency of the emitted light.

Accordingly, applicants dispute that *Shibata I* renders claims 7-11 unpatentable under 35 U.S.C. §103(a), and respectfully request withdrawal of the Section 103(a) rejection based on the *Shibata I* reference.

Dependent claim 15 recites that the semiconductor layer elements each have a diameter or width that includes at most ten pyramid-like structures. The Examiner states that *Shibata I* Fig. 11 shows this but, in fact, the cited figures depict 18 saw teeth. Unless the Examiner can cite a reference that specifically discloses this limitation of claim 15, applicants contend that withdrawal of the Section 103(a) rejection of claim 15 is warranted.

Claim 20 recites the use of at least one of ITO and ZnO as the contact layer. Although *Shibata I* fails to teach this limitation, the Examiner rejected claim 20 on the ground that it would be obvious to use one of these methods to form the transparent electrode layer of *Shibata I*. Unless the Examiner can cite a specific teaching for this substitutability, the Section 103(a) rejection of claim 20 on this ground should be withdrawn.

Finally, amended dependent claim 21 now recites that the semiconductor chip does not contain a growth substrate. *Shibata I* fails to teach or suggest this limitation either alone or in combination with *Shibata II*. Claim 21 is therefore deemed patentable over the cited art for this additional reason.

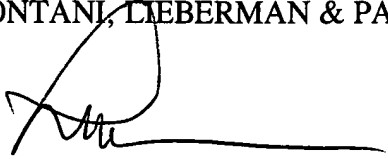
### **Conclusion**

Based on the foregoing, applicants submit that the present application is now in full and proper condition for allowance. Prompt and favorable action to this effect, and early passage of the application to issue, are once more solicited.

Should the Examiner have any comments, questions, suggestions or objections, he is respectfully requested to telephone the undersigned to facilitate an expedited resolution of any outstanding issues.

Respectfully submitted,  
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